U. S. ARMY CORPS OF ENGINEERS

PREP Newsletter

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- ***Updated TM Matrix***

GREETINGS FOR THE MONTH OF JANUARY

Happy post holiday season and I hope your time off was pleasant and exciting (not too exciting). Now the fun starts by taking down the holiday decorations, periodically stubbing your toe on Christmas ball hooks, picking up tinsel for the next three months, and generally cleaning up. Happy New Year!

DEFINITION CORNER

Ethernet: Is a protocol that allows computers to access a network.

TCP/IP: Transmission Control Protocol/Internet Protocol. This is the Internet standard since 1983.

LCP's: Logic Communication Processors. Used to interface SCADA equipment (i.e. intelligent electronic devices (IED's) and remote terminal units (RTU's).

TIDBITS OF KNOWLEDGE

A train in France is capable of traveling 186 MPH.

When trouble shooting a shorted DC conductor that disappears behind a covered area the hidden conductor can be followed by pulsing the DC voltage and following the unseen conductor with a pocket compass.

DC current can not be measured with a traditional current probe. One must use a probe that contains a Hall Effect Sensor.

US Army Corps of Engineers

EXTEND RELIABILITY TO YOUR HOME

At work we are always concerned with maintaining a working system. The plan of attack is to increase the mean time between failures (MTBF) of components, sub-systems, or entire missions. It is highly desirable to replace components or systems before they reach the end of their projected life, when parts become unavailable or when the systems become too costly to maintain.

This same type of philosophy should be extended to your home. A person I know at work recently arrived home only to find her basement filled with water and her well had gone dry. The rubber water hose that supplies hot water to her washer had ruptured. The hose had not been replaced since the family moved in thirteen years ago and the house was twenty-eight years old. Recommended replacement is every three years. Although, in the scheme of things, the reliability of a military communications system far exceeds that of a washer system in a home, reliability in the home hits our pocketbook on the bulls-eye.

WHEN IS A NOTCH NOT A NOTCH

When performing power quality measurements a common disturbance on waveforms is known as notching. This is normally caused by the operation of an SCR (silicon controlled rectifier) or similar device when the rectifier commutates currents from one phase to another (i.e. during the operation of power drive circuitry). Notching can be reduced by inserting an inductor in the circuitry. The notching is a cyclical disturbance and usually will not be a problem (as long as there are no zero crossings)-it's the nature of the beast.

There is another form of notching that can occur that can have very different results. A loose connection can cause similar results on the scope of a power quality analyzer. However, unlike notching due to SCR switching, the waveform (notching as a result of a loose connection or open circuit) disturbance (notch) usually will not be cyclical. How a notch is viewed on a scope will determine how a system is analyzed.

DISTANCE EFFECTS CAPACITOR OPERATION

Capacitor switching can cause high frequency transients on an electrical system. The place that it occurs in the system determines how you analyze electrical waveforms on your power quality analyzer.

The longer the electrical feeder the greater the voltage drop. A voltage drop can effect your electrical system in a negative way. However, distance at times can offset a potential problem. Capacitor switching close to your electrical system can cause a high disturbance on your system (that looks almost like ringing on your waveform). Whereas a waveform of an energized capacitor bank at a distance will have less effects on the waveform (i.e. a slightly distorted waveform).

EMERGENCY PLAN

Since the tragedies of the World Trade Center and the Pentagon we are forced to think about the impossible. In the past we were confident that N + 2 main transformers (where N equals the required number of transformers for normal operation) were more than enough to maintain a high degree of reliability at our critical sites or the ability to continually bring fuel oil trucks to a critical site was "a given" when only standby power was available.

Facility managers should continue to be aware and contemplate what they must do if the "unimaginable " happens. The time to do this is not when "the bomb goes off" but is continuously with a process where "at risk areas" are identified that could effect mission operations. As the areas "of risk" are identified a plan should be established of what to do if the impossible happens.

For example if all N+2 transformers became inoperable, mobile utility transformers could be available, or rental generators could be brought in to the facility. Contingency plans should be in place before the impossible happens.

AN OUNCE OF PREVENTION

A new electrical system will be installed correctly or not regardless of quality control—wrong. Developing an effective plan to verify that your new electrical system is operational and correct is the first step to insure that the project will be cost effective.

Once a system is installed, but before it is accepted a commissioning process should be implemented. In actuality, this process should be started even before the design stage, but this usually is not an alternative.

Each component and system should be tested. Approved operational tests should be approved and performed. Tests should be based on individual operations and maintenance manuals (O&MM) submitted by general contractor. These O&M manuals should be reviewed and approved by commissioning quality control personnel (CQCP). Once approved these manuals should be used as the criteria for developing operational tests for components and systems.

The operational systems tests should be developed by the CQCP. Once developed they should be reviewed by the installation contractor personnel and customer. The actual operational tests should be implemented by contractor personnel and verified by the CQCP.

Commissioning done correctly should be based on a team effort between the contractor, customer commissioning quality control personnel, and in accordance with commissioning standards and criteria. Contractors should be given the opportunity to provide improvements and suggestions to the commissioning process.

INCREASED WIRELESS CAPABILITY

Just as its difficult to see anyone walking down the street anymore without a small box (cell phone) glued to their ear it is also becoming more common to see no hard wiring between PLC's (programmable logic controllers) and system controls for equipment.

In the past, control between a computer and remote plant equipment has been hard wired. A typical installation would have control at a remote generator or pumping station. The system was reliable, but data transmission and controls were limited. However, increased capabilities with RF technology has made wireless technology for plant and remote areas "more achievable". Frequency increases of up to 2.4 GH have allowed a wider range of data transmission over short and medium ranges.

In addition, wireless Ethernet modems can allow a programmer to link software between laptops and PLC's without being concerned with slow data and programming responses. Where new systems are being installed consideration should be given to wireless technology where cost, mobility, and system operation are a concern.

NO TO A FULLY RATED SYSTEM?

An electrical system is fully rated if each overcurrent protective device (fuse or circuit breaker) has an interrupting rating equal to or greater than the maximum available system fault current.

A series rated system is a combination of fuses or circuit breakers that can be applied at available fault levels above the interrupting level on the load side of the breaker. For instance if fault level of 50k amps is available on the load side of a 25k amps rated circuit breaker a rated fuse-circuit breaker combination can be used that is acceptable. However, series rated systems can not be selectively coordinated and extra consideration must be made when large motor loads are present. The preferred method of protection is the fully rated system.

PROBLEMS AT FORT TANK

Joe Sparks slowly got out of his car to approach his office building on Fort Tank. It had been a long vacation and he was "a bit slow getting motivated". However, since Joe had been "out of the loop" for some time there just might be a challenging problem on his desk to get him motivated. Since Joe's job as electrical engineer was to support C4ISR facilities worldwide, it would not be unusual for him to find an interesting task waiting on his desk.

Sure enough as Joe opened the door of his office he noticed a phone message from his old college room-mate John Drill. John had chosen to follow a career path in management where he currently was the Director of Installation Support (DIS) at Fort Beetle Bailey. Joe quickly returned the phone call and it was like "old times" talking to his buddy. After the pleasantries and "fun and games" were exchanged John continued to describe his problem.

Fort Beetle Bailey is supplied electrical power from two 115 kV-13.8 kV delta-wye grounded transformers via a government owned double-ended substation with a normally open tie circuit breaker. There is a South and North side of the substation. Each side has five feeder circuit breakers that distribute power to different parts of the post. However, the South side has a sixth feeder that supplies power to a wye connected capacitor bank used for power factor correction.

The North side feeders when energized operate correctly while the South Side substation experiences arcing within the switchgear DC indicating lights and inside the induction disk relays. When the capacitors are manually disconnected from the system the arcing problems are not present.

John Drill indicated to Joe that the problem was with the capacitor bank but after two weeks of testing and trying different suggestions he was "at a dead end". He could just as well disconnect the capacitors permanently, but that would result in a utility company penalty of $10,000 each month for an unacceptable system power factor.
Joe indicated that he would be attending a training seminar 100 miles North of Fort Beetle Bailey next week and after class he would drive down after class and take a look at the problem (after John provided him with a steak dinner that is).

Going down to see John next week would give Joe a chance to "think about the problem plus develop an appetite".

Next week after class John drove down to see his buddy. After pleasantries were exchanged Joe said let's take a look at your sparking problem and after 30 minutes of looking the system over Joe replied. "I can solve your problem with a pair of bolt cutters." After seeing that Joe was not kidding John walked over to the maintenance truck and returned handing the cutters to his friend. Joe then walked to the capacitor bank and cut a cable that was shown going into the dirt and told John to energized the capacitor bank.

After the bank was energized the power factor hovered at a solid 0.95 without any ill effects in the switchgear controls. John grinning and shaking his head just looked at Joe and said "bolt cutters?".

(Continued on page 5)

PROBLEMS AT FORT TANK (*continued)*

(Continued from page 4)

Joe went on to say that he believed that the public utility electrical system characteristics had probably changed recently (probably due to the addition of a reactor or some harmonic producing equipment installed "up the line"). This could have caused a higher current due to a resonant condition on the system where currents were circulating between the grounded wye connection at the capacitors and the system ground at the substation transformer. This can result in interference to the relay and control system. Solutions usually range from de-tuning the circuit (remove some capacitors or add inductive reactance) or use of bolt cutters. The bolt cutters were used to sever the wye connected ground at the capacitor bank. Wye connected capacitor banks should be ungrounded to eliminate a path for zero sequence harmonics that could flow through the neutral circuit. --"Now lets see about you buying me that steak", said Joe.

LOOK OUTSIDE THE BOX

This is a common expression used by the main actor in the current popular TV show Crime Scene Investigation (CSI). He is always talking about if things do not make sense we should "start looking outside the box". Many times during electrical trouble-shooting or system evaluation of critical power systems our approach is based on site personnel knowledge of systems, observations, and single line diagrams (if they exist at all).

Several weeks ago when evaluating a particular problem at a facility the single line diagrams were available and system operation was described by site personnel. After a short time of not finding the problem we started to question what was correct information and what was not. It turned out that that the single line diagram was not accurate and the site personnel were basing their system operations on inaccurate information. Look outside the box.

NEW STANDBY POWER MEANING?

Traditionally, when talking about standby power one would refer to a generator set or battery system that provides electrical power during a power outage.

Standby power now also refers to the amount of power that an appliance uses when it is turned off or when still connected to power , but is in its lowest possible power mode.

The only certainty that there is, “things will change”.

COMMENTS, SUGGESTIONS, REQUESTS

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Technical Guidance Publications

U.S. Army Corps of Engineers
Special Missions Office
Power Reliability Enhancement Program January 4, 2001

Number and Title	Service	Project Officer	Date of Current Edition	Status
TM 5-682 Facilities Engineering - Electrical Facilities Safety	Army	Ngo	Published 8 November 1999	In distribution & on USACE homepage
TM 5-683, NAVFAC MO-116, AFJMAN 32-1083 Facilities Engineering - Electrical Interior Facilities	Tri-Service	Luu	Published 30 November 1995	In Distribution & on USACE homepage
TM 5-684, NAVFAC MO-200, AFJMAN 32-1082. Facilities Engineering - Electrical Exterior Facilities	Tri-Service	Mundt	Published 29 November 1996	In Distribution & on USACE homepage
TM 5-685, NAVFAC MO-912 Operation, Maintenance and Repair of Auxiliary Generators	Army and Navy	Duong	Published 26 August 1996	In Distribution & on USACE homepage
TM 5-686 Power Transformer Maintenance and Acceptance Testing	Army	Mundt	Published 16 November 1998	In Distribution & on USACE homepage
TM 5-687 Design Criteria, Operation, & Maintenance of Standby Power Automatic Controls for C4ISR Facilities	Army	Mundt	New	Collecting data
TM 5-688 Foreign Voltages and Frequencies Guide	Army	Mundt	Published 12 November 1999	In Distribution & on USACE homepage
TM 5-689 ADP/Computer Electrical Installation & Inspection for C4ISR Facilities	Army	Ngo	Published 10 September 2001	On USACE homepage and in distribution
TM 5-690 Grounding & Bonding in C4ISR Facilities	Army	Ngo	New BWXT Y-12	Incorporating MACOM comments
TM 5-691 Utility Systems Design Requirements for C4ISR Facilities	Army	Cundiff	Published 15 December 2000	On USACE homepage and in distribution

Technical Guidance Publications (Continued)

U.S. Army Corps of Engineers
Special Missions Office
Power Reliability Enhancement Program January 4, 2001

Number and Title	Service	Project Officer	Date of Current Edition	Status
TM 5-692-1 Maintenance of Mechanical and Electrical Equipment at C4ISR Facilities Recommended Maintenance Practices	Army	Cundiff	Published 15 April 2001	On USACE homepage and in distribution
TM 5-692-2 Maintenance of Mechanical and Electrical Equipment at C4ISR Facilities System Design Features	Army	Cundiff	Published 15 April 2001	On USACE homepage and in distribution
TM 5-693 Uninterruptible Power Supply System Selection, Installation & Maintenance for C4ISR Facilities	Army	Duong	New BWXT Y-12 Oak Ridge, TN	Working on Final Draft (which will go to MACOMs)
TM 5-694 Commissioning of Electrical Systems for C4ISR Facilities	Army	Mundt	New BWXT Y-12 Oak Ridge, TN	Working on Final Draft (which will go to MACOMs)
TM 5-697 Commissioning of Mechanical Systems for C4ISR Facilities	Army	Cundiff	New BWXT Y-12 Oak Ridge, TN	Working on First Draft. Due January 2002
TM 5-698-1 Reliability/Availability Analysis of Electrical & Mechanical Systems for C4ISR Facilities	Army	Hale	New - Reliability Analysis Center	First Draft Due February 2002
TM 5-698-2 Reliability Centered Maintenance for C4ISR Facilities	Army	Hale	New - Reliability Analysis Center	Funding Provided Collecting data
TM 5-698-3 Reliability Primer for C4ISR Facilities	Army	Hale	New - Reliability Analysis Center	Collecting data
PREP Tech Note 1. Manpower for Utility Systems Staffing for C4ISR Facilities Addenda to TM 5-691 and TM 5-692-1	Army	Cundiff	New – to be done in house	Working on first draft, collecting info
TM 5-699 Fiberoptics Installation and Maintenance for C4ISR Facilities	Army	Stoyas	New	Seeking Funding

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